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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/903,222	07/10/2001	Shreyas Kher	005212/TCG/SPC/SB	9971

32588 7590 09/10/2003

APPLIED MATERIALS, INC.
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EXAMINER	
MARKHAM, WESLEY D	

ART UNIT	PAPER NUMBER
1762	

DATE MAILED: 09/10/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/903,222	KHER ET AL.	
	Examiner	Art Unit	
	Wesley D Markham	1762	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

P riod for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on _____ .

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) 1-12 is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) 1-12 is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☒ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on 10 July 2001 is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

DETAILED ACTION

1. Claims 1 – 12 are currently pending in U.S. Application Serial No. 09/903,222, and an Office Action on the merits follows.

Information Disclosure Statement

2. Acknowledgement is made of the IDSs filed by the applicant on 7/10/2001 and 12/23/2002. The references listed thereon have been considered by the examiner as indicated on the attached copies of the PTO-1449 forms.

Drawings

3. The formal drawings (4 sheets, 4 figures) filed by the applicant on 7/10/2001 are approved by the examiner.

Specification

4. The title of the invention is not descriptive of the claimed invention and contains too many characters (i.e., it is too long). A new title is required that is clearly indicative of the invention to which the claims are directed. The following title is suggested: "Method of Depositing a Thin Metal-Oxide Film for DRAM Capacitor Application".

Claim Rejections - 35 USC § 112

5. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

6. Claims 5 – 10 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.
7. Regarding Claim 5 (from which Claims 6 – 8 depend), the claim recites, in part, "...wherein at least a first mixture of precursor gases is used in a first step and a second mixture of precursor gases is used in a second step." Claims 6 – 8 also refer to mixtures of precursor gases. However, independent Claim 1, from which Claim 5 depends, refers to one or more vaporized liquid precursors, not precursor gases. Therefore, it is unclear whether the "first mixture of precursor gases" and the "second mixture of precursor gases" recited in Claims 5 – 8 (1) are equivalent to a mixture of the vaporized liquid precursors recited in Claim 1, (2) simply include the vaporized liquid precursors (e.g., along with other gaseous precursors), or (3) are entirely different from the vaporized liquid precursors recited in Claim 1. As such, the scope of Claims 5 – 8 is unclear, and the claims are indefinite under 35 U.S.C. 112, second paragraph.
8. Regarding Claim 8, the claim recites, in part, "...wherein said first mixture of precursor gases and said second mixture of precursor gases comprises BST and oxygen." However, as known in the art and defined by the applicant in the specification of the instant application (see, for example, page 1, line 11, of the specification), "BST" is a barium strontium titanium oxide film, not a precursor gas or a gas of any sort. As such, it is unclear to what precursor gas "BST" refers in the

context of Claim 8, thereby rendering the scope of the claim unclear. For the purposes of examination only, the examiner has reasonably interpreted the term "BST" to be equivalent to "one or more vaporized liquid precursors comprising barium, strontium, or titanium" (i.e., precursors that can be used to form a BST film).

9. Claim 9 (from which Claim 10 depends) recites the limitation "said process" in line 1 of the claim. There is insufficient antecedent basis for this limitation in the claim. Specifically, Claim 9 recites, "...wherein said process is halted for a predetermined waiting period..." However, independent Claim 1 (from which Claim 9 depends) does not explicitly refer to "a process" – the claim refers to a method of depositing a thin metal-oxide film that comprises a number of different process steps. Therefore, it is unclear what "process" is halted. In other words, is it (1) the overall method of depositing a thin metal-oxide film that is halted, or (2) one or more of the processes recited in steps (a) through (c) (i.e., the delivering and/or vaporizing processes) that is halted? The scope of the claim is vague, and the claim is indefinite under 35 U.S.C. 112, second paragraph.

Claim Rejections - 35 USC § 102

10. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent

granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

11. Claims 1, 2, 4, 5, and 7 – 12 are rejected under 35 U.S.C. 102(b) as being anticipated by DiMeo, Jr. et al. (USPN 5,972,430), referred to hereinafter as DiMeo.

12. Regarding independent Claim 1 (from which Claims 2 – 12 depend) DiMeo teaches a method of depositing a thin metal-oxide film having a uniform thickness of about 200 A or less (Abstract, Col.1, lines 14 – 42, Col.4, lines 58 – 67, Col.5, line 1, Col.9, lines 34 – 38, and Col.10, lines 30 – 40), the method comprising the steps of delivering one or more liquid precursors to a vaporizer (Figure 1, Col.7, lines 51 – 67, and Col.8, lines 1 – 3), vaporizing the one or more liquid precursors (Col.7, lines 64 – 67, and Col.8, lines 1 – 3), delivering the vaporized precursors to a deposition chamber to deposit a film on a substrate (Figure 1, Col.6, lines 64 – 67, Col.7, lines 1 – 7 and 51 – 67, and Col.8, lines 1 – 21), and repeating the aforementioned steps at least one time (Figures 2 and 3, Col.9, lines 21 – 67, Col.10, lines 1 – 40 and 65 – 67, and Col.11, lines 1 – 21).

13. DiMeo also teaches all the limitations of Claims 2, 4, 5, and 7 – 12 as set forth above in paragraph 12 and below, including a method wherein / further comprising:

- Claims 2 and 4: at least a first precursor flow rate is used in a first step and a second precursor flow rate is used in a second step (Claim 2), and the first precursor flow rate and the second precursor flow rate are the same (Claim 4)

(Figures 2 and 3, Col.10, lines 30 – 40, Col.11, lines 1 – 21, and Examples 1 – 2).

- Claims 5 and 7: at least a first mixture of precursor gases is used in a first step and a second mixture of precursor gases is used in a second step (Claim 5), and the first mixture of precursor gases and the second mixture of precursor gases are the same (Claim 7). Specifically, DiMeo teaches using a mixture of at least a first vaporized precursor reactant (i.e., a first precursor gas) and a second vaporized precursor reactant (i.e., a second precursor gas) in a "first step" (i.e., PROCESS CYCLE 1 in Figure 3), and the same mixture of precursor gases in a "second step" (i.e., PROCESS CYCLE 2 in Figure 3) (Col.9, lines 21 – 37, Col.10, lines 20 – 40, Col.11, lines 2 – 21, and Examples 1 – 2).
- Claim 8: the first mixture of precursor gases and the second mixture of precursor gases comprises BST (i.e., one or more vaporized liquid precursors comprising barium, strontium, or titanium that can be utilized to deposit a BST film) and oxygen (Figures 2 and 3, Col.9, lines 21 – 38 and 53 – 67, Col.11, lines 1 – 21, and Examples 1 – 2, in which vaporized liquid precursors containing barium, strontium, and titanium (flow "PW1" in Figure 3), and oxygen gas (flow "PW3" in Figure 3) are utilized in both a "first step" (PROCESS CYCLE 1 in Figure 3) and a "second step" (PROCESS CYCLE 2 in Figure 3) to deposit a BST film).

- Claims 9 and 10: the process is halted for a predetermined waiting period prior to repeating steps (a) through (c) in Claim 1 (Claim 9), particularly for between about 10 seconds and about 300 seconds (Claim 10). Specifically, if one considers the inert gas purge steps PW2 and the oxidant gas introduction step PW3 to be the "waiting period" between the vaporization and delivery of the liquid precursor steps PW1 in PROCESS CYCLES 1 and 2, the "waiting period" in DiMeo is from 2 to 120 seconds (i.e., a value within the applicant's claimed range) (Figure 3 and Col.11, lines 1 – 21). If one only considers the second inert gas purge step PW2 in the to be the "waiting period", the "waiting period" in DiMeo is from 0.5 to 30 seconds (i.e., a value that is also within the applicant's claimed range) (Figure 3 and Col.11, lines 1 – 21).
- Claims 11 and 12: a film prepared by the method of Claim 1 (Claim 11), and a DRAM capacitor comprising the aforementioned film (Claim 12) (Abstract, Col.1, lines 14 – 42, Col.4, lines 58 – 67, Col.5, line 1, Col.7, lines 8 – 18, Col.9, lines 34 – 38, and Col.10, lines 30 – 40).

14. Claims 11 and 12 are rejected under 35 U.S.C. 102(e) as being anticipated by Itsuki et al. (USPN 6,485,554 B1).

15. Regarding Claims 11 and 12, Itsuki et al. teaches a DRAM capacitor comprising a thin metal-oxide (i.e., BST) film having a uniform thickness of about 200 A or less (Abstract, Col.1, lines 10 – 40, Col.4, lines 23 – 44, Col.8, lines 40 – 42, and Examples 1 – 38). The thin BST film is deposited by an MOCVD method of

vaporizing liquid barium-, strontium-, and titanium-containing precursor materials, transporting the vaporized materials to a deposition chamber, and depositing the BST film on a substrate in the presence of oxygen gas (see Example 1). It is the examiner's position that the BST film / DRAM capacitor taught by Itsuki et al. is equivalent to the applicant's claimed film / DRAM capacitor because the only difference in the process claimed by the applicant in Claim 1 (i.e., the process used to deposit the film and form the DRAM capacitor claimed in Claims 11 and 12) and the process taught by Itsuki et al. is that the process steps of applicant's Claim 1 are repeated, and the process steps of Itsuki et al. are not. This repetition of steps would not materially affect the deposited BST film.

Claim Rejections - 35 USC § 103

16. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

17. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order

for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

18. Claims 1 – 8, 11, and 12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kawahara et al. (USPN 5,834,060) in view of either Basceri et al.(1) (USPN 6,319,764 B1) or Basceri et al.(2) (USPN 6,444,478 B1).

19. Regarding independent Claim 1, Kawahara et al. teaches a method of depositing a thin metal oxide film having a uniform thickness (Abstract, Col.4, lines 38 – 40, Col.5, lines 12 – 15, and Col.9, lines 51 – 54), the method comprising the steps of delivering one or more liquid precursors to a vaporizer, vaporizing the one or more liquid precursors, delivering the vaporized precursors to a deposition chamber to deposit a film on a substrate (Figures 27 and 28, Col.18, lines 50 – 67, and Col.19, lines 1 – 57), and repeating the aforementioned steps at least one time (Abstract, Figures 10, 12, and 19, Col.10, lines 66 – 67, Col.11, Col.12, lines 1 – 20, and Col.13, lines 23 – 54). Kawahara et al. does not explicitly teach that the film has a thickness of about 200 A or less. However, it is the focus of Kawahara et al. to deposit a thin BST film that is used as a DRAM capacitor (Abstract, Col.1, lines 16 – 30 and 50 – 59, Col.4, lines 15 – 27, and Examples 11 – 12). The thin BST film taught by Kawahara et al. has a thickness of, for example, 30 nm (i.e., 300 A) (Col.20, lines 49 – 57) or 240 A (Col.9, lines 51 – 54). In addition, Kawahara et al. acknowledges a disadvantage (i.e., a high leakage current) of using a BST film as thick as 30 nm as a capacitor (Col.4, lines 46 – 61). Both Basceri et al.(1) and

Basceri et al.(2) teach that BST films having a thickness of less than 200 A can be successfully deposited by MOCVD and utilized as a DRAM capacitor (Abstract and Col.4, lines 10 – 52 of Basceri et al.(1); and Abstract, Cols.1 - 2, Col.4, lines 28 – 54, and Cols.7 – 9 of Basceri et al.(2)). Therefore, it would have been obvious to one of ordinary skill in the art to deposit the BST film of Kawahara et al. to a uniform thickness of about 200 A or less with the reasonable expectation of (1) success, as both Basceri et al. references teach that BST films having a thickness of less than 200 A can be successfully deposited by MOCVD and utilized as a DRAM capacitor (i.e., the BST film application desired by Kawahara et al.), and (2) obtaining the benefits of depositing a film having a thickness of less than 200 A (i.e., a film thinner than the one taught by Kawahara et al.), such as reducing the deposition time, thereby providing a process with higher throughput, reducing the amount of precursor materials required to perform the deposition process, and reducing the leakage current by using a BST film having a thickness smaller than, e.g. 30 nm, as the DRAM capacitor.

20. The combination of Kawahara et al. and either Basceri et al.(1) or Basceri et al.(2) also teaches all the limitations of Claims 2 – 8, 11, and 12 as set forth above in paragraph 19 and below, including a method wherein / further comprising:

- Claims 2 - 4: at least a first precursor flow rate is used in a first step and a second precursor flow rate is used in a second step (Claim 2), and the first precursor flow rate and the second precursor flow rate are different from one another (Claim 3) or the same (Claim 4). For example, as evidenced by

Figures 10 and 12 of Kawahara et al., a first precursor flow rate is used in the deposition time period of from 0 to 2 minutes (i.e., in a "first step"), and a second, different precursor flow rate is used in the deposition time period of from 2 minutes to 8 minutes (i.e., in a "second step"). Likewise, as evidenced by Figure 19 of Kawahara et al., a first precursor flow rate is used in the deposition time period of from 0 to 2 minutes (i.e., in a "first step"), and a second, different precursor flow rate is used in the deposition time period of from 2 minutes to 4 minutes (i.e., in a "second step"). Alternatively, as evidenced by Figure 19 of Kawahara et al., a first precursor flow rate is used in the deposition time period of from 0 to 2 minutes (i.e., in a "first step"), and a second precursor flow rate that is the same as the first precursor flow rate is used in the deposition time period of from 4 to 6 minutes (i.e., in a "second step").

- Claims 5 - 7: at least a first mixture of precursor gases is used in a first step and a second mixture of precursor gases is used in a second step (Claim 5), and the first mixture of precursor gases and the second mixture of precursor gases are different from one another (Claim 6) or the same (Claim 7). For example, as evidenced by Figure 19 of Kawahara et al., a first mixture of precursor gases (i.e., a strontium / titanium precursor mixture) is used in the deposition time period of from 0 to 2 minutes (i.e., in a "first step"), and a second, different mixture of precursor gases (i.e., a barium / titanium precursor mixture) is used in the deposition time period of from 2 minutes to 4

minutes (i.e., in a "second step"). Alternatively, as evidenced by Figure 19 of Kawahara et al., a first mixture of precursor gases is used in the deposition time period of from 0 to 2 minutes (i.e., in a "first step"), and a second mixture of precursor gases that is the same as the first mixture of precursor gases is used in the deposition time period of from 4 to 6 minutes (i.e., in a "second step").

- Claim 8: the first and second mixture of precursor gases comprises BST and oxygen (see Figures 10 and 12, Examples 2 and 3, Col.18, lines 50 – 58, and Col.19, lines 30 – 32 of Kawahara et al.).
- Claims 11 and 12: a film prepared by the method of Claim 1 (Claim 11), and a DRAM capacitor comprising the aforementioned film (Claim 12) (see the discussion of the DRAM capacitor of the combination of Kawahara et al. and either Basceri et al.(1) or Basceri et al.(2) set forth above in paragraph 19).

21. Claims 9 and 10 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kawahara et al. (USPN 5,834,060) in view of either Basceri et al.(1) (USPN 6,319,764 B1) or Basceri et al.(2) (USPN 6,444,478 B1), in further view of Cho et al. ("Improvement of dielectric properties of $(Ba,Sr)TiO_3$ thin films deposited by pulse injection chemical vapor deposition", *Applied Physics Letters*, 1998).

22. The combination of Kawahara et al. and either Basceri et al.(1) or Basceri et al.(2) teaches all the limitations of Claims 9 and 10 as set forth above in paragraphs 19 and 20, except for a method wherein the process is halted for a predetermined

waiting period prior to repeating (Claim 9), particularly for between about 10 seconds and about 300 seconds (Claim 10). Specifically, Kawahara et al. is silent regarding any waiting period. However, Cho et al. teaches that, in the art of depositing BST films by MOCVD for DRAM capacitors (i.e., a process analogous to that of Kawahara et al.), it is desirable to pause for a time period of, for example, 20 seconds, between successive precursor introduction steps (Abstract and page 786). When the precursor is only introduced periodically (i.e. due to the pause periods), a high-quality BST film can be deposited, and the film shows better crystallinity and less carbon contamination than continuously deposited BST thin films (page 788, Col.2). Therefore, it would have been obvious to one of ordinary skill in the art to halt the BST deposition process of the combination of Kawahara et al. and either Basceri et al.(1) or Basceri et al.(2) for 20 seconds between successive precursor introduction steps with the reasonable expectation of successfully and advantageously depositing a high-quality BST film in a DRAM capacitor (as desired by Kawahara et al.) that shows better crystallinity and less carbon contamination than a continuously deposited BST film.

23. Claims 1, 2, 4, 5, and 7 – 12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Cho et al. ("Improvement of dielectric properties of (Ba,Sr)TiO_3 thin films deposited by pulse injection chemical vapor deposition", *Applied Physics Letters*, 1998) in view of DiMeo, Jr. et al. (USPN 5,972,430) and either Basceri et al.(1) (USPN 6,319,764 B1) or Basceri et al.(2) (USPN 6,444,478 B1).

24. Regarding independent Claim 1, Cho et al. teaches a method of depositing a thin metal-oxide (i.e., BST) film having a uniform thickness of about 35 nm (i.e., 350 A), the method comprising delivering a mixture of barium-, strontium-, and titanium-containing precursors, along with oxygen gas, into a deposition chamber to deposit a film on a substrate, pausing for a predetermined period of time, and then delivering the aforementioned mixture of precursors to the chamber again (i.e., repeating the process) (Abstract, page 786, and Figure 1). Cho et al. does not explicitly teach (1) how the precursors are delivered to the chamber (i.e., that the precursors are delivered to a vaporizer and then vaporized prior to being delivered to the chamber), or (2) that the BST film has a thickness of about 200 A or less. However, the precursors used by Cho et al. include $Ba(TMHD)_2$, $Sr(TMHD)_2$, and $Ti(O\text{-}i\text{-}C_3H_7)_4$ (page 786), and the method by which these precursors are delivered to the deposition chamber does not appear to be critical in the process of Cho et al. DiMeo teaches that barium, strontium, and titanium precursors such as the ones taught by Cho et al. are typically mixed with an appropriate solvent, delivered as a liquid to a vaporizer, vaporized, and then delivered to a deposition chamber to deposit BST films for DRAM capacitor applications (Col.7, lines 8 – 18 and 64 – 67, Col.8, lines 1 – 3, and Col.12, lines 1 – 34). Therefore, it would have been obvious to one of ordinary skill in the art to vaporize and deliver the precursors of Cho et al. to the deposition chamber in the manner claimed by the applicant and taught by DiMeo with the reasonable expectation of successfully and advantageously utilizing a well-known precursor delivery method in order to supply the precursors of Cho et al. to

the deposition chamber of Cho et al. and deposit the BST film, as desired by Cho et al. Further, both Basceri et al.(1) and Basceri et al.(2) teach that BST films having a thickness of less than 200 A can be successfully deposited by MOCVD (i.e., the process taught by Cho et al.) and utilized as a DRAM capacitor (Abstract and Col.4, lines 10 – 52 of Basceri et al.(1); and Abstract, Cols.1 - 2, Col.4, lines 28 – 54, and Cols.7 – 9 of Basceri et al.(2)). Therefore, it would have been obvious to one of ordinary skill in the art to deposit the BST film of Cho et al. to a uniform thickness of about 200 A or less with the reasonable expectation of (1) success, as both Basceri et al. references teach that BST films having a thickness of less than 200 A can be successfully deposited by MOCVD and utilized as a DRAM capacitor (i.e., the BST film application desired by Cho et al.), and (2) obtaining the benefits of depositing a film having a thickness of less than 200 A (i.e., a film thinner than the 350 A film taught by Cho et al.), such as reducing the deposition time, thereby providing a process with higher throughput, and reducing the amount of precursor materials required to perform the deposition process.

25. The combination of Cho et al., DiMeo, and either Basceri et al.(1) or Basceri et al.(2) also teaches all the limitations of Claims 2, 4, 5, and 7 – 12 as set forth above in paragraph 24 and below, including a method wherein / further comprising:

- Claims 2 and 4: at least a first precursor flow rate is used in a first step and a second precursor flow rate is used in a second step (Claim 2), and the first precursor flow rate and the second precursor flow rate are the same (Claim 4) (see Figure 1 of Cho et al. and the associated description).

- Claims 5 and 7: at least a first mixture of precursor gases is used in a first step and a second mixture of precursor gases is used in a second step (Claim 5), and the first mixture of precursor gases and the second mixture of precursor gases are the same (Claim 7) (see Figure 1 and Table 1 of Cho et al., and the associated description).
- Claim 8: the first mixture of precursor gases and the second mixture of precursor gases comprise BST and oxygen (see Figure 1 and Table 1 of Cho et al.).
- Claims 9 and 10: the process is halted for a predetermined waiting period prior to repeating steps (a) through (c) in Claim 1 (Claim 9), particularly for between about 10 seconds and about 300 seconds (Claim 10). Specifically, Cho et al. teaches a pause period of about 20 seconds (page 786, Col.2).
- Claims 11 and 12: a film prepared by the method of Claim 1 (Claim 11), and a DRAM capacitor comprising the aforementioned film (Claim 12) (see the discussion of the DRAM capacitor of the combination of Cho et al., DiMeo, and either Basceri et al.(1) or Basceri et al.(2) set forth above in paragraph 24).

Conclusion

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Yu et al. (USPN 6,008,143) and Stauf et al. (USPN 6,277,436 B1) both teach liquid delivery MOCVD processes that can be utilized to deposit BST

films for DRAM capacitors. Van Wijck (USPN 6,592,942 B1) teaches an ALD process than can be utilized to deposit thin metal oxide films.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Wesley D Markham whose telephone number is (703) 308-7557. The examiner can normally be reached on Monday - Friday, 8:00 AM to 4:30 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Shrive Beck can be reached on (703) 308-2333. The fax phone number for the organization where this application or proceeding is assigned is (703) 872-9306.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0661.

Wesley D Markham
Examiner
Art Unit 1762

WDM

SHRIVE P. BECK
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 1700